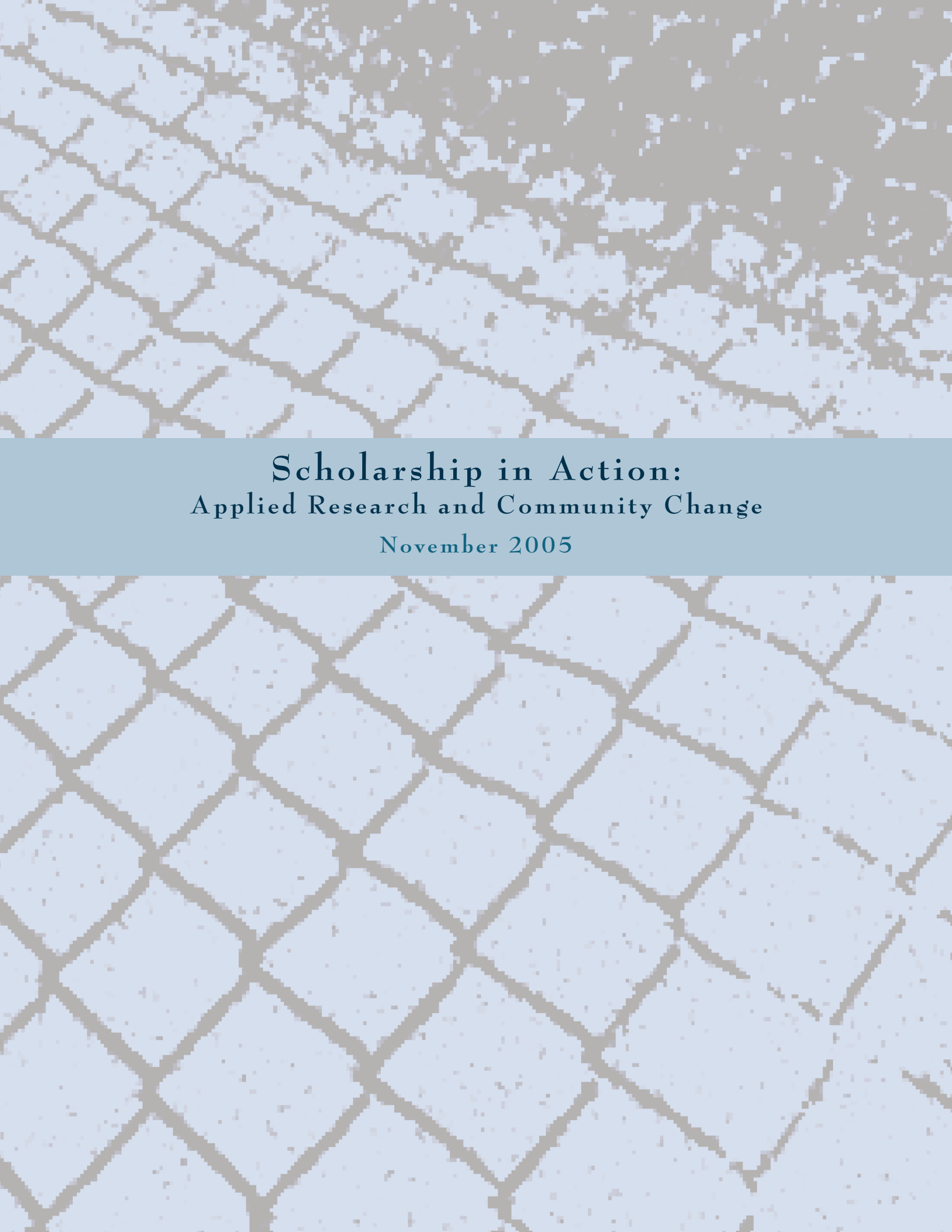

Scholarship in Action:
Applied Research and Community Change

November 2005

Scholarship in Action is a monograph that highlights the benefits derived from engaged, community-based research; showcases emerging applied research; and identifies the challenges associated with applied research. The unifying theme throughout this collection is how much communities and universities can achieve by working together in research partnerships.

Opinions expressed in these articles are those of the authors and do not necessarily reflect the views and policies of the U.S. Department of Housing and Urban Development.

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Creating Tools for Deliberative Community Planning Through Interdisciplinary Research and Community Engagement

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Abstract

In 2003 researchers and undergraduate students in the Worcester Community Project Center (WCPC) at Worcester Polytechnic Institute (WPI) formed a partnership with the city of Worcester, Massachusetts, to explore issues related to ongoing pressures on the city's development patterns. Worcester needed assistance in creating a series of suitability maps that would provide development guidance to its neighborhood planners; the city also wanted to involve the public in this suitability analysis. This project provided an opportunity for WPI's faculty and students to explore ways in which new technology could be used more effectively to involve a community in decisionmaking. During the project an interdisciplinary team of faculty and students developed and piloted a GIS-based decision tool that enables interested groups to visualize, in real time, the implications of their planning decisions on a variety of community scales. This paper describes how WCPC teams developed the decisionmaking tool within WPI's community partnerships, which are designed to bring together student learning and community needs. Particular attention is given to the students' educational process and the ways in which student learning can be transformed as a result of participating in complex, multisemester research projects.

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Introduction

Many U.S. cities continue to experience rapid urban growth that is fueled by low interest rates and public investment in the regeneration of downtown districts. The consequences of such growth for cities across the country have been an ever-increasing market-rate housing stock and rising property values. The Commonwealth of Massachusetts and its second largest city, Worcester, are no exceptions.

Underutilized buildings in inner-city Worcester are being transformed from their former industrial uses to housing stock and mixed-use developments. Green space and farmland are being recruited into production to feed the region's appetite for housing. According to the Massachusetts Audubon Society's report *Losing Ground* (2003), 40 acres per day of *green space* was lost to housing development between 1985 and 1999. Despite the 10,000 new homes built each year, housing costs continue to rise about 17 percent a year in central and eastern Massachusetts (Boston Foundation 2004). Indeed, the region's housing deficit remains high, and some 44,000 units are needed to fill the demand. Moreover, as

Boston continues to develop outward toward Worcester, the number of vehicles using local highways continues to increase by about 34.6 percent (Boston Foundation 2004).

In 2000 then-Governor Paul Cellucci authorized Executive Order 418 (EO 418), which made funding available so that every Massachusetts city and town could examine the tensions between economic development, housing, open space, and transportation. The primary vehicle for these analyses was *suitability mapping*. Suitability mapping refers to a process whereby planners examine the appropriateness or *suitability* of current and possible future land uses and identify the highest value for a parcel or parcels of land in some larger policy context. *Highest use* does not imply *highest market value*. Rather, it implies the *best* use of land, given abutting uses and larger social need.

Two years after EO 418 was authorized, researchers and undergraduate students in WPI's Worcester Community Project Center (WCPC) formed a partnership with the city of Worcester to explore ongoing pressures created by the city's development patterns. The goal of the project was to create a series of suitability maps that would provide development guidance to neighborhood planners and policymakers. Public involvement was an important component of this project. Indeed, public deliberation on the suitability criteria was a key early step in WCPC's approach, which sought to find a good way to engage local residents in a discussion about suitability that would not be too abstract and distant from their concerns. Through a yearlong project, a team composed of faculty and students developed and piloted a decisionmaking tool, based on the geographical information system (GIS), which would enable interested groups in Worcester to visualize, evaluate, and make recommendations for suitability criteria in real time.

This article begins by describing WPI's institutional infrastructure, which enabled students to participate in this project. The article then summarizes the process that WCPC research teams followed and describes the development of the GIS-based decisionmaking tool, called the Interactive Visualization Tool (InVsT). The article concludes with reflections on the transformation of both faculty and students that resulted from this project.

WPI's Project-Based Learning Approach

Each university has its own approach to involving students in community partnerships that support student learning. More than 25 years ago, WPI instituted project-based learning as a major component of the university's degree requirements. All WPI students must complete three project-based degree requirements during their time at WPI: a capstone experience in the humanities and arts; a senior project experience in the student's major; and an interdisciplinary, *service-learning* project experience during the student's junior year. Of the three project requirements, the interdisciplinary service-learning project, which explores technology-society relationships, is perhaps the most innovative. Faculty advisors receive teaching credit for supervising the project and helping students solve policy-oriented problems at the nexus of techno-scientific and social themes.

Over the years WPI has developed an internal infrastructure—called the Global Perspective Program—to support its growing service-learning initiative. Students can now complete their junior projects at one of 14 project centers around the world, from Boston to Bangkok, Thailand. Each center has a director who solicits projects from public agencies, private companies, educational institutions, and nonprofit organizations, such as nongovernmental organizations (NGOs).

The off-campus centers proved so effective in achieving the educational goals of the junior year project that WPI established the Worcester Community Project Center (WCPC) 5 years ago. WCPC is housed in the school's Division of Interdisciplinary and Global Studies. The center brings together interdisciplinary teams of faculty and students to engage in urban policy problems facing the city of Worcester and the region, and it offers WPI students unique, well-structured opportunities to explore the social dimensions of science and technology. WCPC serves students

who were not seeking an international experience, allowing them to complete outreach projects without leaving Worcester or traveling abroad. In addition, a separate WCPC initiative aims to improve the academic quality of local projects by adapting best practices developed at distant residential project sites to the Worcester program.

WCPC outreach projects carry substantial weight in the student's overall degree requirements and count as approximately nine courses. Typically, each project team spends about 1,000 hours working with a community sponsor during two of WPI's 7-week terms, which are equivalent to one 14-week semester at other schools.

A key attribute of WCPC's interdisciplinary service-learning projects is their team orientation. At the beginning of the first term, students are assigned to teams of three or four, depending on their project preferences. Typically, the teams engage in a preparation period during the first term of the program, taking a single class, ID 2050, and attending a weekly team meeting with their faculty advisors. During the second term, the entire team works full time on its project with its sponsoring organization. This gives students an ideal opportunity to have meaningful experiences beyond the *gated community* of the college campus.

During the project's preparation period, each student team member is expected to strengthen his or her critical thinking skills by becoming familiar with the project and its location, learning about the various analytical tools that will be employed during the project, and writing about the planned project. This learning process allows students to see firsthand that all technological problems are embedded in a social context. By the end of the preparation period, the student teams are expected to develop well-crafted proposals that set out the plan for how they will execute their research during the following term.

A single course—ID 2050—is the prerequisite for students who wish to complete any WCPC project. Each of WPI's international and domestic project centers has its own variant of ID 2050, and the course content varies depending on the particular community projects offered each semester. However, the overall course objectives remain constant: to enhance student skills in the area of critical thinking, written and oral expression, teamwork, and civic engagement. These objectives and the course structure embody WPI's model for service learning, which Hunter and Brisbin (2000) define as "a form of experimental education that combines structured opportunities for learning academic skills, reflection on the normative dimensions of civic life, and experimental activity that addresses community needs or assists individuals, families and communities in need." (See also Krueger and Schachterle 2002.) The WPI course provides students with the basic skills and knowledge they will need to complete their projects, including general information about social science research methods and the concepts of urban systems and change. Weekly meetings provide faculty and their student teams with a forum to discuss project details.

The 7-week implementation period is very demanding for students, who typically spend 40–50 hours per week conducting interviews, collecting data, and writing up a professional report that proposes solutions to a particular agency's problem and balances technical solutions with financial and social feasibility. WCPC has provided dozens of such reports to the city of Worcester, ranging from park and playground maintenance to the development of cultural industries.[1]

Community Planning in Practice: Developing Technology for Public Deliberation

During the October–December 2003 term, project teams focused on development issues that arise in the context of contemporary social and economic demands. The projects placed a particular emphasis on sustainable urban development, using Hall (1998) as a primary textbook. The intent was to help students see that the problems facing urban America are far from irreversible, and that students can be participants in the solutions not only as project team members, but also in their civic lives now and in the future. Students also received instruction in GIS and the policy context of the Massachusetts Executive

Order 418 (EO 418), through which the city had received funds to examine the tensions between economic development, housing, open space, and transportation.

The research team for the project included faculty and undergraduate students from a number of disciplines.[2] Participating faculty had backgrounds in management, electrical engineering and computer science, urban planning, and economic development. The nine student researchers involved in the project represented similar majors.

In preparation for the project, the principal investigator[3] and the faculty advisors worked with the city of Worcester to develop three projects that could satisfy the needs of the city and the terms of the city's EO 418 grant. Individual teams were linked to each of the theme areas that required examination under the grant: economic development, housing, and open space. Each team was expected to produce a suitability map, based on its theme area, which graphically displayed local-level data on such features as the industrial structure of the city, resident characteristics, and the location of open space. The student researchers on the economic development team were Christopher Moller, Jessica Jajosky, and Joshua Zarr. Student housing researchers included Nina Mallozi, Akrad Hamir, and Kate Traynor. Jason Farmer, Jennifer Settle, Matthew St. Pierre, and Christopher Wall comprised the open space team.

Throughout their ID 2050 course, student researchers worked in a seminar environment as they grappled with key concepts. Each of these seminar and team meetings was crucial to the team's ability to complete their proposal's three sections. Drawing on academic literature in the area of urban development allowed students to situate Worcester within a regional and global context. Understanding various policy problems allowed them to contextualize the EO 418 approach and to grapple with how EO 418 sought to address the urban problems that they had discussed more abstractly earlier in the course. Learning about GIS and the types of available data helped students to understand that not all data are equally appropriate in every context. Each phase of this process was linked to a person in Worcester with whom the students could interact. The project's short-term goal was to provide students with information about the structure of their city government and to familiarize them with information sources within that government that could help them complete their projects. Students attended relevant administrative and board-related meetings and began to understand how their government works from both the political and administrative ends. Moreover, as they began speaking with neighborhood activists of various stripes, students began to understand firsthand the complexity of the relationship between the city government and the citizens of Worcester. Over the long term, however, WCPC wanted students to recognize that, regardless of their career choices, they had something to contribute to civic life after the project was over.

During the project's implementation phase, students worked with the city of Worcester's Planning Director Joel Fontane. All faculty advisors remained on the project during this phase, although students worked in city offices and met with their faculty advisors on a weekly basis. Basically, student teams worked with community partners to provide data, analysis, and recommendations for the city of Worcester's EO 418 Community Development Plan. As mentioned above, suitability maps were central to this endeavor.

Suitability and GIS

Suitability analysis provides a powerful tool for screening potential uses in the early stages of planning. The concept of suitability is standard in the planning literature, but EO 418 required that suitability criteria be confirmed through a public participation process. One of the stated purposes of the former governor's initiative was to "engender local conversations among citizens to explore possible community futures" (Executive Order 418 2000, 2.) The WCPC team not only wanted to start these conversations, but also to find ways to sustain them and create opportunities to empower marginalized groups and constituencies. Examining the dynamic relation-

ships between economic development, housing development, open space, and transportation was required by the grant. However, WCPC's larger research goal was to consider how student teams could make use of technology to facilitate more deliberative and more equitable planning decisions. The WPI project would test strategies for integrating public deliberation with GIS analysis (Krueger et al. 2005).

The prospect of bringing GIS to students and the community presented exciting opportunities for everyone. Students, for example, were able to experience firsthand the implications that technology held for examining social problems and policies. For the community, this project created an opportunity for more meaningful deliberation about important issues. These deliberations were particularly meaningful because, as a tool, GIS does much more than simply show static maps or graphs of a community's characteristics. Rather, it brings those characteristics to life. Unlike other mapping software, GIS helps people analyze spatial data through map *layers,* which represent such local characteristics as topography, roads, rivers and streams, and even buildings. By deploying different layers simultaneously, analysts can develop maps that are customized to illustrate particular community problems.

In recent years scholars and practitioners alike have looked for ways to bring GIS from the domain of planners and other analysts to communities (Sheppard 1995; Craig and Elwood 1998; Nedovic-Budic 1998). Most recently, these efforts have emerged under the auspices of Public Participation in GIS (PPGIS), which has promulgated literature about unequal access to the technology (Lietner et al. 2000); the social and political implications of the use of technology (Sheppard et al. 1999; Ghose 2003; Ghose and Elwood 2003); as well as the actual process by which GIS is used in the public decision-making process (Jankowski and Nyerges 2001; Craig, Harris, and Weiner 2002; Drew 2003; Grossardt, Bailey, and Brumm 2003). Indeed, the PPGIS literature has helped create exciting opportunities for communities to develop their GIS capacity and has helped make GIS analysis more responsive to specific community needs.

Because GIS enables analysts to actually *see* relationships among and between parcels, it provided a useful platform through which WPI's student teams could examine the complexity of suitability. To allow the public to see these relationships as well, the student teams had to determine how to structure a public participation process. The teams also had to develop a methodology for piloting a tool that would facilitate that involvement.

The first challenge of the project was defining suitability, an abstract concept with which people often struggle. Student teams needed to develop a public participation process that would help citizens understand the concept and participate in discussions about how suitability would be defined. Students would then develop draft suitability criteria and present those criteria to the public. Once this was accomplished, the students would ask citizens to deliberate on these criteria, using a computer tool called the Interactive Visualization Tool, or InVsT. (For a full description of the process and data collection methodology see Krueger et al. 2005; Benoit et al. 2004; Hamir, Mallozzi, and Traynor 2003; Farmer et al. 2003; and Zarr, Jojosky, and Moller 2003).

Student teams began the tool development process by creating a set of suitability criteria for each of the predetermined themes. The initial suitability criteria drew from the planning literature and from informal interviews students held with planning experts (Fontane 2003; Novick 2003; Scanlan, 2003). These initial suitability criteria were then used to assess the availability of data. Practical concerns—like whether basic GIS data layers were available—played an important role in criteria selection. Student teams could create new GIS layers if supporting data were unavailable on open space, unused parcels, and housing types. However, lack of data would make it difficult for city residents to evaluate suitability at the parcel level. Once the student teams ensured that the basic data requirements were satisfied, they began locating actual quantitative data sources, including archival data (assessor's data) and existing data available through the U.S. Census Bureau, Bureau of Labor Statistics, and

the North American Economic Classification System (NAECS).

In the next phase of the project, the students combined their working suitability criteria with the quantitative data to produce the suitability maps for economic development, open space, and housing. The housing team, for example, identified seven factors related to the three dimensions of housing suitability that were drawn from the city's goal to create an adequate mix of affordable, market rate, and specialized housing. The economic development team established seven factors for assessing economic development suitability across the four broad business segments. One factor, for example, was the proximity of buildings to rail spurs, which would help with the transportation of goods. The teams examined manufacturing, rather than service-sector activities, because the quantitative data and location quotient analysis suggested that Worcester has a critical mass of manufacturing jobs despite the downward trend nationally. Both the literature and the Worcester context informed the suitability criteria.

Case Example: Housing Suitability Analysis

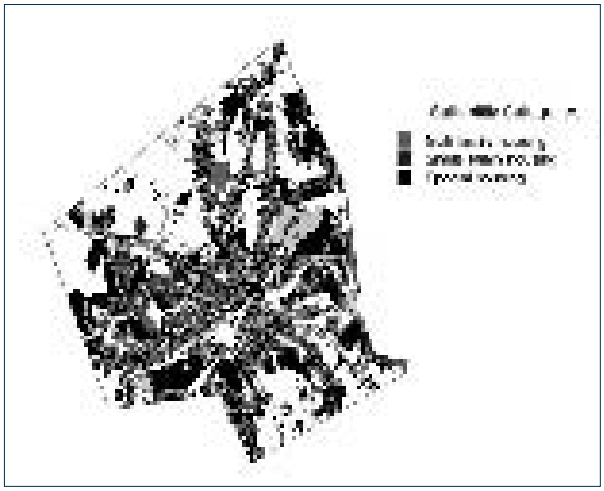
The housing analysis began with a thorough housing inventory. Such an inventory was not available through the city of Worcester, so students turned to other sources, locating a recent study conducted by RKG Associates (2002), a consulting firm working for the city. From this source, the student team developed a housing market profile and typology. The team then classified Worcester's housing into types by parcel. Again, students encountered challenges. The Worcester Assessor's data does not explicitly describe land use; the data set does, however, contain useful descriptions of buildings using 103 different descriptors (Hamir et al. 2003). Despite the difficulties with classification, the housing team found that it was able to analyze the housing suitability for two fundamental types of dwellings: single family and multifamily.

The student teams needed to be able to present their information in ways that community residents and policymakers could visualize. To simplify this visualization, the suitability analysis for housing was divided into three subcategories: single-family, multifamily, and special needs and elderly housing. The suitability criteria determined most appropriate for the suitability calculations were lot size, accessibility, and proximity to open space. Map 1 was the result.

GIS technology helped the student teams identify sets of suitable uses versus unsuitable uses. The resulting maps revealed not only the *highest* suitable use, but also made unsuitable uses clear.

This suitability map reveals that downtown Worcester and areas along major arteries are best suited for multifamily houses.

Map 1. Housing Suitability for Worcester



Developing and Piloting InVsT

To this point all of the teams' suitability criteria and analysis had been completed in a vacuum, without public input. The teams did not know whether their criteria were relevant or legitimate. Indeed, they did not know whether, in the eyes of the community, the criteria were sufficient and satisfactory. To solicit public input, the team developed a computerized tool that allowed members of the public to interact with the three databases developed for housing, open space, and economic development. During focus groups, members of the public could use the tool to make dynamic modifications in the relative importance of each set of suitability criteria associated with each of these study areas. One exciting aspect of the tool was that it produced results in *real time*

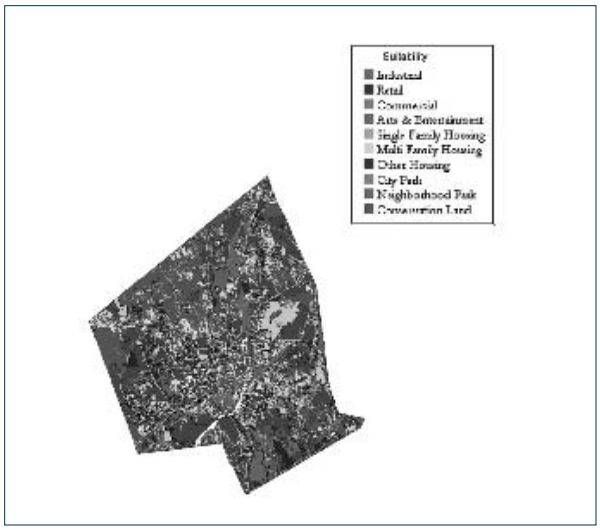
so that citizens engaged in the planning process could see immediately the implications of their land-use decisions.

The purpose of the focus groups was to inform people of the ongoing community development planning process that was part of EO 418 and to pilot test the InVsT. The focus groups were derived from a convenience sample—teams selected names from various lists gathered from local nonprofit and governmental organizations. In addition, teams identified key individuals whose perspective would inform the process. In total, the population sample included more than 200 names from economic development, business, nonprofit and community-based organizations, and environmental groups. From this sample the researchers randomly selected 35 people of various backgrounds to participate in the focus groups. These people were invited to 1-hour meetings held in various points around the city.

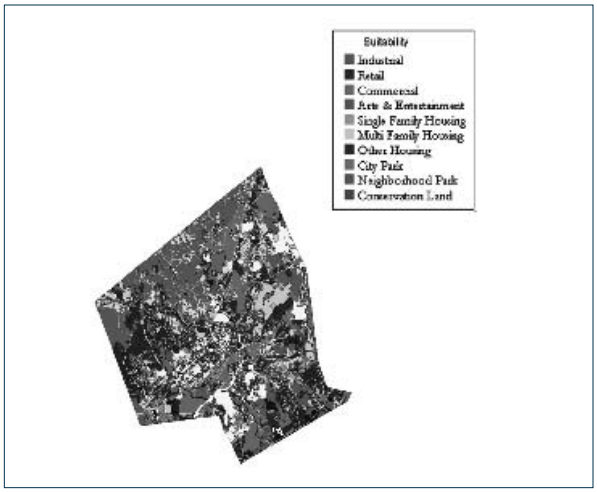
Focus group discussions were divided into three segments:

- **A brief overview** of the project, suitability mapping, and InVsT.
- **A discussion about the team's maps and a ranking of suitability criteria.** Through the course of the focus groups, the teams asked participants to respond to the criteria weights that researchers had established and suggest additional suitability criteria. For example, one focus group participant suggested that the open space team add a new criterion relating to the ecological importance of preserving parcels for open space. WPI's criteria had focused on population density and setting a number of open space acres per capita. However, the citizen in question felt that a parcel's suitability for development should also include data about watershed protection or biodiversity. The teams' challenge was to take this and other suggestions under advisement and seek out geocoded data sources (like NAECS codes for economic development) that could be used to create new GIS layers.
- **The development of alternative suitability maps.** During this segment of the meeting, the participants took a survey, which asked them to weight the teams' suitability criteria and to suggest new criteria. Based on the results of this survey, the teams used the InVsT interface to develop a new suitability map for each theme in each focus group. Maps 2 and 3 illustrate the differences between the research team weights and weights suggested by the focus groups.

Map 2. Research Team Map



Map 3. Focus Group Map



Summary: Interdisciplinary Research That Matters

The community development plan for the city of Worcester was successfully completed in 2004. Since then, some members of the WCPC team

(two faculty members and a student) have continued to refine the InVsT tool and apply it to new contexts. In fall 2005, two new teams of students began working with Worcester Common Ground, a local community development corporation, on an externally funded project that will focus on economic development in Worcester's Piedmont neighborhood, a highly mobile immigrant community adjacent to WPI. The students will use GIS, InVsT, and other conventional economic data collection and analysis techniques to make recommendations for helping neighborhood residents start and sustain businesses in the local community.

Not all research projects will use tools like InVsT to bring scholarship into community service. The ability to participate in funded city projects involving technology such as GIS comes with experience. Scholars who are engaging in community research and service-learning for the first time should ease into projects and establish working relationships and project expectations with sponsors.

To conclude, community-based research is time consuming and often challenging. Public participation and technology such as GIS often compound these challenges. Yet, this kind of research must not only continue, it must be fostered. Over the past 20 years WPI has developed the infrastructure to get faculty and students off campus to assist communities in Worcester and around the world. Like the project discussed above, these experiences bring benefits to communities, students, and faculty. For communities, the innovation that comes from the interaction with an interdisciplinary team of faculty and students often makes the impossible plausible. Through the process, faculty and students, especially those coming from the science and engineering fields, realize that they can make contributions in ways they never imagined.

Not one team member could have developed the InVsT tool alone. All were needed. The social scientist asked the question, the computer scientist developed the software to ask it, and the urban planner helped deliver it to the public. Students need this type of scholarly interaction, and they benefit from the experience, which prepares them to enter industries where work groups often include members with diverse educational backgrounds. The team approach reminded engineering and science students how crucial it is to understand the broader context around science and technology policy issues.

Notes

1. For more information on these or any WCPC projects, please contact Rob Krueger.
2. The team also included graduate students hired from Clark University in Worcester and Antioch-New England Graduate School.
3. Rob Krueger was the project's principal investigator. He is the director of the Worcester Community Project Center, and taught this section of ID 2050.

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